

Application No. 09/997,543
Amendment "A" and Response dated October 31, 2005
Reply to Office Action mailed 06/15/2005

AMENDMENTS TO THE CLAIMS

The listing of claims will replace all prior versions and listings of claims in the application:

1- 23 (Cancelled)

24. (Currently Amended) In a computer system having a mass storage device that stores data blocks, a method of creating a snapshot copy of selected data blocks, comprising the acts of:

receiving information from a user designating a subset of data blocks of the mass storage device to be included in a snapshot copy that is to preserve the designated subset of the data blocks as the designated subset data blocks existed at a first point in time,

ensuring that the designated data blocks are in a logically consistent state such that the first point in time corresponds to a time when no activity exists on the mass storage device;

as the data blocks at the mass storage device change after the first point in time, identifying the data blocks of the designated data blocks subset that change at the mass storage device;

preserving a copy of the data blocks of the designated data blocks subset that change, wherein the preserved copy of the changed data blocks represents an original copy of said data blocks of the designated subset data blocks prior to changing; and

providing access to the snapshot copy of the designated subset of the data blocks.

25. (Currently Amended) The method of claim 24, wherein the snapshot copy is created without disrupting user access to the designated data blocks ~~computer system~~ to the extent that users are able to continue to issue I/O requests to the mass storage device as the snapshot copy is created.

26. (Currently Amended) The method of claim 24, wherein the act of identifying the data blocks of the designated data blocks subset that change at the mass storage device

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comprises the act of maintaining a table that includes an entry for at least the data blocks of the designated subset that have changed after the first point in time.

27. (Currently Amended) The method of claim 24, further comprising the act of maintaining the snapshot copy as a backup of the designated ~~subset of the~~ data blocks as the designated data blocks ~~subset~~ existed at the first point in time.

28. (Currently Amended) The method of claim 24, further comprising the act of restoring the designated ~~subset of~~ data blocks using the snapshot copy after experiencing data loss at the mass storage system after the first point in time.

29. (Currently Amended) The method of claim 24, wherein the snapshot copy includes:

the preserved copy of the changed data blocks for those data blocks of the designated ~~subset~~ data blocks that have changed; and

original copies of those data blocks of the designated ~~subset of the~~ data blocks that have not changed after the first point in time.

30. (Currently Amended) The method of claim 29, further comprising the act of creating a second snapshot copy of the designated ~~subset of the~~ data blocks as the designated ~~subset~~ data blocks existed at a second point in time, including:

as the data blocks at the mass storage device change after the second point in time, and in response to the information, identifying the data blocks of the designated ~~subset~~ data blocks that change at the mass storage device;

preserving a copy of the data blocks of the designated ~~subset~~ data blocks that change after the second point in time, wherein the copy of the changed data blocks represents an original copy of said data blocks of the designated subset prior to changing after the second point in time; and

providing access to the second snapshot copy of the designated subset of the data blocks, wherein the second snapshot copy includes:

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the preserved copy of the changed data blocks for those data blocks of the designated subset data blocks that have changed after the second point in time;
and

original copies of those data blocks of the designated ~~subset of the~~ data blocks that have not changed after the second point in time.

31. (Previously Presented) The method of claim 24, wherein the act of providing access to the snapshot copy comprises the act of permitting a user to change data blocks of the snapshot copy, such that the snapshot copy represents a changed version of the designated subset of the data blocks.

32. (Previously Presented) The method of claim 24, wherein the act of providing access to the snapshot copy comprises the act of enabling read access to the snapshot copy.

33. (Previously Presented) The method of claim 24, wherein the act of providing access to the snapshot copy is performed while providing ongoing access to the data blocks stored in the mass storage device.

34. (Previously Presented) The method of claim 24, wherein the act of preserving a copy of the data blocks of the designated subset that change is performed by preserving a copy of the data blocks of the designated subset only in response to a first change thereof after the first point in time and not in response to any subsequent changes.

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35. (Currently Amended) In a computer system having a mass storage device that stores data blocks, a method of restoring data of the mass storage device using a snapshot copy of selected data blocks, comprising the acts of:

maintaining a snapshot copy of a designated subset of the data blocks stored in the mass storage device, the snapshot copy preserving the designated subset of the data blocks as the designated subset existed at a first point in time and wherein the snapshot copy is created at a time when the designated subset of the data blocks is in a logically consistent state such that no activity is present on the mass storage device, wherein the snapshot copy includes:

preserved copies of those data blocks of the designated subset of the data blocks that have changed at the mass storage device after the first point in time; and

original copies of those data blocks of the designated subset of the data blocks that have not changed after the first point in time;

experiencing loss of at least some of the designated subset of the data blocks at the mass storage device after the first point in time; and

restoring the designated data blocks of the mass storage device using the snapshot copy.

36. (Previously Presented) The method of claim 35, wherein the designated subset has been selected by a user of the computer system.

37. (Previously Presented) The method of claim 35, wherein the act of restoring the designated data blocks comprises the act of restoring the designated data blocks to the state in which they existed at the first point in time.

38. (Currently Amended) The method of claim 35, wherein the act of experiencing loss of at least some of the designated data blocks comprises the acts of:

experiencing a condition that results in corruption of said at least some of the designated data blocks; and

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prior to the corruption of said at least some of the designated data blocks, preserving a copy of said at least some of the designated subset, wherein the copy of the changed data blocks represents an original copy of said at least some of data blocks.

39. (Previously Presented) The method of claim 35, wherein the act of preserving the snapshot copy comprises the acts of:

as data blocks are stored in the mass storage device, receiving from the user information that identifies the designated subset of the data blocks selected by the user;

as the data blocks at the mass storage device change after the first point in time, and in response to the information, identifying the data blocks of the designated subset that change at the mass storage device; and

preserving the copy of the data blocks of the designated subset that change, wherein the copy of the changed data blocks represents an original copy of said data blocks of the designated subset prior to changing.

40. (Previously Presented) The method of claim 35, further comprising the act of maintaining one or more other snapshot copies of the designated subset of the data blocks as they existed at the mass storage device at other points in time after the first point in time.

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41. (Currently Amended) In a computer system having a mass storage device that stores data blocks, a method of providing users access to a snapshot copy of selected data blocks while providing ongoing access to the data blocks stored on the mass storage device, comprising the acts of:

receiving an instruction to create a snapshot copy of selected data blocks;

ensuring that the selected data blocks are in a logically consistent state such that no activity is present regarding at least the selected data blocks;

maintaining [[a]] the snapshot copy of a designated subset of the selected data blocks stored in the mass storage device, the snapshot copy preserving the designated subset of the selected data blocks as the designated subset selected data blocks existed at a first point in time, wherein the snapshot copy includes:

preserved copies of those data blocks of the designated subset of the selected data blocks that have changed at the mass storage device after the first point in time; and

original copies of those data blocks of the designated subset of the selected data blocks that have not changed after the first point in time;

providing access to the snapshot copy of the designated subset of the selected data blocks, such that changes to the snapshot copy do not change the selected data blocks stored on the mass storage device; and

while providing access to the snapshot copy, providing access to the selected data blocks stored on the mass storage device, such that changes to the selected data blocks stored on the mass storage device [[to]] do not change the snapshot copy.

42. (Currently Amended) The method of claim 41, wherein the ~~designated subset is~~ selected data blocks are selected by a user of the computer system.

43. (Previously Presented) The method of claim 41, wherein the act of providing access to the snapshot copy comprises the act of providing write access to the snapshot copy by which the data blocks of the snapshot copy can be changed.

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44. (Currently Amended) The method of claim 41, further comprising the act of maintaining one or more other snapshot copies of the ~~designated-subset-of-the~~ selected data blocks as they existed at the mass storage device at other points in time after the first point in time.

45. (Currently Amended) The method of claim 41, further comprising the acts of:
as data blocks are stored in the mass storage device, receiving from the user information that identifies the ~~designated-subset-of-the~~ selected data blocks selected by the user;

as the data blocks at the mass storage device change after the first point in time, and in response to the information, identifying the data blocks of the selected data blocks ~~designated-subset~~ that change at the mass storage device; and

preserving the copy of the data blocks of the ~~designated-subset~~ selected data blocks that change, wherein the copy of the changed data blocks represents an original copy of said data blocks of the selected data blocks ~~designated-subset~~ prior to changing.

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46. (Currently Amended) In a computer system having a mass storage device that stores data blocks, blocks, a method of creating multiple snapshot copies of selected data blocks, comprising ~~the acts of~~:

maintaining a first snapshot copy of a first designated subset of the data blocks stored in the mass storage device, the snapshot copy preserving the first designated subset of the data blocks as the first designated subset existed at a first point in time, wherein the first snapshot copy is created at a first time when the designated subset of data blocks is in a logically consistent state such that no activity is present in the mass storage device, wherein the first snapshot copy includes:

preserved copies of those data blocks of the subset of first designated data blocks that have changed at the mass storage device after the first point in time; and

original copies of those data blocks of the first designated subset of the data blocks that have not changed after the first point in time; and

maintaining a second snapshot copy of a second designated subset of the data blocks stored in the mass storage device, the snapshot copy preserving the second designated subset of the data blocks as the designated subset existed at a second point in time, wherein the second snapshot copy is created at a second time when the designated subset of data blocks is in a logically consistent state such that no activity is present in the mass storage device, wherein the second snapshot copy includes:

preserved copies of those data blocks of the second designated subset of the data blocks that have changed at the mass storage device after the second point in time; and

original copies of those data blocks of the second designated subset of the data blocks that have not changed after the second point in time.

47. (Previously Presented) The method of claim 46, wherein the first designated subset and the second designated subset are selected by a user of the computer system.

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48. (Previously Presented) The method of claim 46, further comprising the act of providing access to the first snapshot copy of the first designated subset of the data blocks while independently providing access to the data blocks stored on the mass storage device.

49. (Previously Presented) The method of claim 46, wherein the first period of time is different from the second period of time.

50. (Previously Presented) The method of claim 46, wherein the first designated subset of the data blocks is different from the second designated subset of the data blocks.

51. (Previously Presented) The method of claim 46, further comprising the act of maintaining the first and second snapshot copies as backups of the first and second designated subsets of the data blocks, respectively.

52. (Previously Presented) The method of claim 46, further comprising the act of restoring the first designated subset of the data blocks using the first snapshot copy after experiencing data loss at the mass storage system.

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53. (New) In a computer system having a mass storage device that stores data blocks and has access to a data storage location that contains a snapshot copy of the data blocks, a method of backing up the data blocks in the snapshot copy, the method comprising:

initiating the creation of a snapshot copy of data blocks stored on a mass storage device at a first time when the data blocks are in a logically consistent state on the mass storage device, wherein the snapshot copy initially contains data blocks that are identical to the data blocks at a time prior to the first time;

during a time period between the first time and a second time, tracking changes to the data blocks of the mass storage device so as to identify which data blocks change in the time period; and

at the second time when the data blocks are in a logically consistent state, initiating an update of the snapshot copy by transmitting only those data blocks that have changed during the time period between the first time and the second time to the snapshot copy such that the snapshot copy includes a copy of the data blocks as the data blocks existed on the mass storage device at the second time.